Evaluation of visibility maximum range of laser navigation system beacons and spatial guiding lines in different weather conditions

© V.E. Karasik, E.E. Mukhina, V.M. Orlov

Bauman Moscow State Technical University, Moscow, 105005, Russia

The unique properties of laser light, and above all, small angular divergence, allow the use of lasers for navigation systems of planes landing. Even a relatively low-power laser can create beacons, which range exceeds the long-rang of traditional navigation lights with incandescent power of several kilowatts. Vividly advantage of laser beacons is seen in conditions of poor visibility due to the specific of the laser radiation spreading in the atmosphere.

Using the radiation transfer equation in the atmosphere the visibility range calculation method of course and glidepath laser beacon in landing system "Glissade" and the definition of the apparent length of the spatial guiding lines created by these beacons due to the scattering of laser radiation in the atmosphere. The concept of an "appearance beams" was determined from the condition of the color contrast threshold exceeding which level depends on the brightness of the background. In calculating of the laser beacons and spatial guide lines visibility distance for small optical thickness a good approximation to the brightness transfer equation solution is the approximation of single scattering. On the basis of this approximation a series of calculations for atmospheric haze from the meteorological visibility range (MDV) S_m in the range of 1 to 5 km was held. For an average density of fog in the S_m in the range of 0,3 to 1,0 km calculation was performed with taking into account the multiple scattering.

Keywords: *course and glide laser navigation system, visibility, the transfer equation, the laser beacon, single scattering, small-angle approximation, the method of calculation*

Karasik V.E. (b. 1939) graduated from Bauman Moscow Higher Technical School in 1964. Dr. Sci. (Eng.), Professor of the Laser and Optoelecrtonic Systems Department of Bauman Moscow State Technical University. Author of more than 150 publications in the field of laser probe, detecting, laser ranging.

Mukhina E.E. (b. 1973) graduated from Bauman Moscow State Technical University in 1998. Ph. D., Assoc. Professor of Laser and Optoelecrtonic Systems Department of Bauman Moscow State Technical University. Author of more than 20 publications in the field of laser location and laser imaging.

Orlov V.M. (b. 1936) graduated from Moscow Institute of Chemical Machinery in 1959. Dr. Sci. (Phys.&Math.). Author of more than 150 publications in the field of laser location and optics of atmosphere.